E-Mobility: the Italian Project

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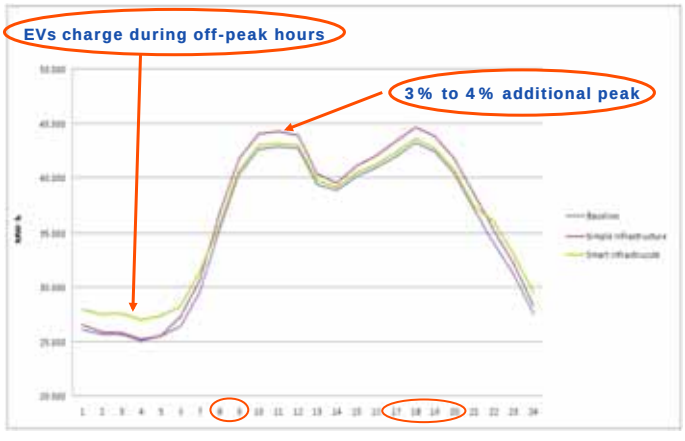
EV drivers

Impact on the grid



- Case study: 4 million EVs will require more than 24 GWh per day
- Clients' usual behaviors implies EVs connection in peak time

- **Smart infrastructure is essential to delay recharge in off-peak times**

Using a smart infrastructure, vehicles shall mainly be charged
- **during off-peak hours**
- **when there is more energy from renewable sources.**

The need for infrastructure

Enel's charging stations in e-mobility Italy

Home

Functionalities

- Network access with RFID ID card
- Identification and authorization to charge from EMM system
- GPRS communication enabled
- Power line communication enabled
- Data acquisition and transmission of every single charge procedure
- Remote monitoring and availability check
- Recharge process remote control

Public

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G4V: EV impact on Distribution Grids

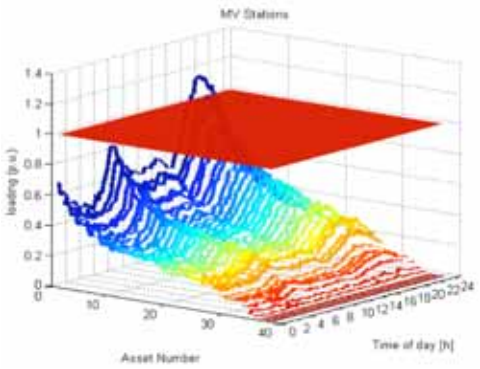
Stochastic approach

Inputs:

- Collection of 200 real grid data (MV & LV)
- Driving patterns from mobility study
- 8 different EVs control strategies

Outputs:

- Overloads in lines and sub-stations
- Required reinforcement investment
- Technical parameters (security margins, energy and power in violation)



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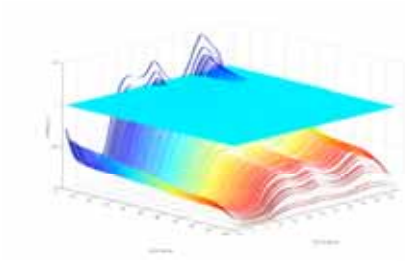
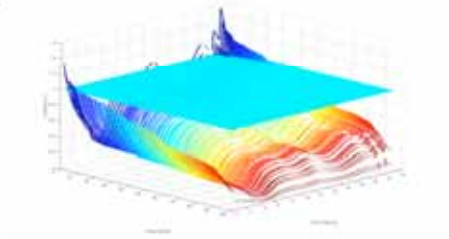
Control strategies: Conservative Scenario



Uncontrolled

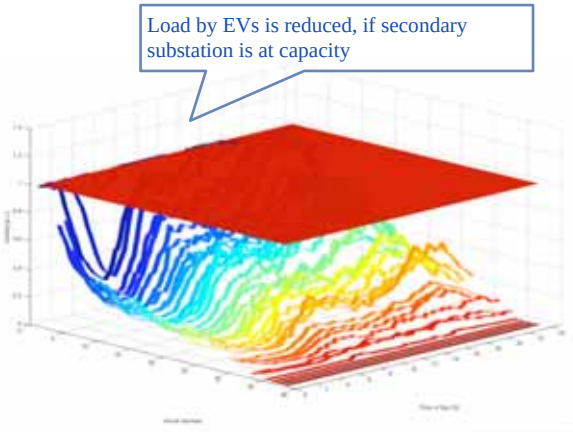


Tariff Control

Examples

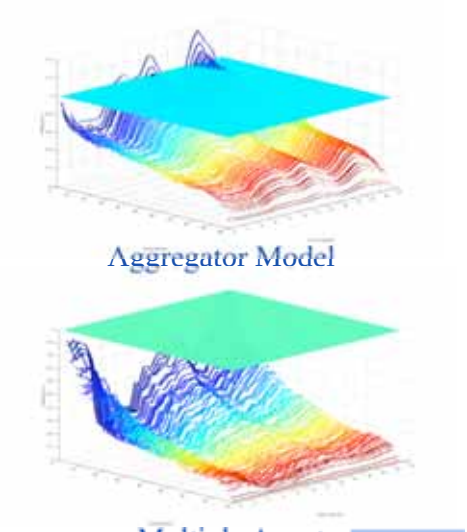
Control strategies: Pragmatic Scenario

- Pragmatic solutions envisage an active role of the DSO
- Charging process integrate into smart grid solutions.
- Those solutions are achievable within today technology and regulatory conditions
- Possible to host higher percentage of EVs



Control strategies: Advanced Scenario

- More advanced solutions, for example using the Aggregator or multiple agents, can provide additional benefits for the electrical system such as higher integration of renewables
- To introduce them additional researches are needed; for example to integrate them in grid congestion management



Aggregator Model

Multiple Agents
(Powermatcher)

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Simulation results

- Using control strategies is possible to reduce and postpone grid reinforcement
- To apply some of the control strategies it is required to implement smart grid functionalities
- Moreover, there is the opportunity to use EVs to offer services to the electric system (e.g. integration of renewable sources)

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